

422 Rec'd PCT/PTO 0 5 JUN 2000

5/pts

1

MAILBOX ANSWERPHONE SERVICE FOR MOBILE COMMUNICATIONS

a

Field of the Invention

This invention relates to mobile communications, and more particularly but not exclusively to apparatus for use in a mobile communications system such as a GSM (Global System for Mobile communications) digital cellular radio network, and to a method of providing a message service to a user of such a mobile communications system.

a

Background of the Invention

A conventional GSM network is schematically illustrated in Figure 1.

005000-15099900

A mobile switching centre (MSC) 2 is connected via communication links to a number of base station controller (BSCs) 4. The BSCs 4 are dispersed geographically across areas served by the mobile switching centre 2. Each BSC 4 controls one or more base transceiver stations (BTSs) 6 located remote from, and connected by further communication links to, the BSC 4. Each BTS 6 transmits radio signals to, and receives radio signals from, mobile stations 8 which are in an area served by that BTS 6. That area is referred to as a "cell". A GSM network is provided with a large number of such cells, which are ideally contiguous to provide continuous coverage over the whole network territory.

A mobile switching centre 2 is also connected via communication links to other mobile switching centres in the remainder of the mobile communications system 10, and to a public service telephone network (PSTN), which is not illustrated. The mobile switching centre 2 is provided

with a home location register (HLR) 12 which is a database storing subscriber authentication data including the international mobile subscriber identity (IMSI) which is unique to each mobile station 8. The IMSI is also stored in the mobile station in a subscriber identity module (SIM) along with other subscriber-specific information.

The mobile switching centre 2 is also provided with a visitor location register (VLR) 14 which is a database temporarily storing subscriber authentication data for mobile stations which are active in the area served by the mobile switching centre 2.

The mobile switching centre 2 may also be provided with a subscriber location register (SLR) 18 which is a database storing data relating the HLRs and VPSs of the network with the network's subscribers.

The GSM network supports a variety of services. One such service is an answerphone service. The answerphone service, among other services, is implemented on a Voice Processing System (VPS) 16. The VPS 16 is linked to the mobile switching centre 2. Incoming calls to the MSC 2 which are not answered by a called subscriber are automatically forwarded to the VPS 16. Figure 1 only illustrates a single VPS 16. However, a mobile communications network generally comprises several VPSs 16 each serving a plurality of subscribers. Various implementations of the answerphone service are possible, of which one example is described below.

In the implementation which this invention concerns, the answerphone service is accessed by means of one or more directory numbers which may be called by all, or at least a plurality of, subscribers, and possibly non-subscribers, to access the service (hereinafter referred to as "common telephone numbers of the answerphone service"). For a subscriber, the common number may be dialled manually, or generated by the handset itself on the subscriber pressing a "dial answerphone option".

In other implementations, each subscriber is provided with two directory numbers, one identifying the subscriber's handset and the other identifying the subscriber's mailbox. If a call is made to the number identifying the subscribers mailbox, the subscriber is allowed to access their messages, if any, sometimes subject to entry of a personal PIN code for the subscriber.

The answerphone service provides a personal mailbox for each subscriber to the answerphone service. When a call is forwarded to a subscriber's mailbox, a personal message of the subscriber is played to the caller. The caller may then leave a voice message in the mailbox. The subscriber is notified by a GSM short message that a message has been deposited in the subscriber's mailbox. The subscriber can then access his/her mailbox in order to retrieve the message.

A call to the subscriber which is not answered is automatically forwarded to the answerphone service and the called subscriber's telephone

5

10

15

20

subscriber), the call is directed to the answerphone service via the visited network. However, no CLI is transmitted and the subscriber is not forwarded automatically to his/her mailbox. Rather, the mailbox number has to be entered manually to identify the mailbox from which a call is to be retrieved.

### *Summary of the Invention*

a  
5 According to one aspect of the present invention, there is provided a method of providing a mailbox answerphone service to a caller in a mobile communications system during a call directed to a directory number used commonly by different ones of the system's subscribers to access their mailboxes, wherein said answerphone service identifies a mailbox associated  
10 with a subscriber by means of an identification code, said method comprising: entering either a first mode of answerphone operation or a second, different, mode of answerphone operation in dependence on information received during call establishment indicating whether said call is of international origin.

15 If a subscriber is roaming, a conditionally diverted call is forwarded to the home network via a visited network using the common number for the answerphone service.

20 Using the present invention, a conditionally diverted call of international origin can be distinguished from an international retrieval call even though the visited network may not transmit a divert flag. In an embodiment of the invention, an incoming international conditionally diverted call may initially automatically be treated in the same manner as an incoming

international retrieval call, the caller may enter an indicator when message deposit is desired or vice-versa.

The CLI is generally lost when a call originating in a visited network is transmitted to the home network. Accordingly, though a diverted call is forwarded to the answerphone service using the international diversion number, the subscriber's mailbox cannot be accessed automatically by the VPS without the CLI. With an embodiment of the present invention, the user enters the required identification code for the VPS to access the subscriber's mailbox.

10 According to a further aspect of the invention there is provided a method of providing a mailbox answerphone service to a caller in a mobile communications system, wherein said answerphone service identifies a mailbox associated with a subscriber by means of an identification code, said method comprising: receiving a call from a mobile handset, said call being  
15 directed to a directory number used commonly by different subscribers to access their mailboxes; allowing said caller to input a selection indicator during said call; and (a) if said indicator is not received, detecting a first identification code associated with said mobile handset from information received during call establishment and providing a message retrieve service to  
20 allow the caller to retrieve messages from the mailbox associated with said first identification code, or (b) if said indicator is received, allowing the user to input a second identification code and providing a message retrieve service

to allow the caller to retrieve messages from the mailbox associated with said second identification code.

A subscriber is thus able to use another subscriber's handset to retrieve a message from his/her mailbox, whilst the retrieval call is otherwise automatically forwarded to the mailbox associated with the subscriber of the used handset.

### Brief Description of the Drawings

An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a block diagram of a mobile communications network;

Figure 2 is a flow diagram showing an overview of steps taken by a VPS when receiving a call in accordance with the embodiment of the present invention;

Figure 3 is a flow diagram showing steps taken by a VPS when in a normal deposit mode in accordance with the embodiment of the present invention;

Figure 4 is a flow diagram showing steps taken by a VPS when in a normal retrieve mode in accordance with the embodiment of the present invention; and

Figure 5 is a flow diagram showing steps taken by a VPS when in an international mode in accordance with the embodiment of the present invention.

## Detailed Description of the Invention

a

Figure 1 shows a conventional mobile communications network. The mobile communications network is described in detail hereinabove and will not be repeated. The answerphone service and the service module in accordance with the embodiment of the present invention are implemented on the VPS 16. However, alternatively, the service module may also be provided outside the VPS 16 as a separate station with links to the VPS 16 and the MSC 2.

Figure 2 illustrates the steps taken by the service module in the VPS 16 when processing a call directed to a common telephone number of the answerphone service. After a call is received in step 20, the service module checks in step 22 whether the incoming call is a diverted call, i.e. whether a divert flag in the communications protocol from the MSC 2 is set. Such information is generally only available in the signalling associated with a call if the subscriber uses his/her handset within the home network area, i.e. if the subscriber's handset communications with the MSC 2 via the BTSs 6 and the BSCs 4 rather than via a visited network. In the case of a set divert flag, the service module proceeds to the normal deposit mode in step 24 as is described hereinbelow in connection with Figure 3. If the divert is not set, the service module checks in step 26 whether the incoming call is provided with the CLI information. If this is the case, it can be assumed that the caller is a subscriber who calls from inside the home network (the CLI is not passed over the international interconnect signalling links) and wishes to retrieve a message



from the answerphone service. Accordingly, the service module proceeds to the normal retrieval mode at step 28 which is described in connection with Figure 4, identifying the mailbox from the subscriber's CLI.

If the CLI is not present, the service module checks in step 30 whether  
5 the number of the mailbox (the directory number of the subscriber having the mailbox) to be accessed is known. This may be the case if the mailbox number was previously entered by the caller (a procedure to be described below) and the call subsequently is diverted to another VPS due to a call drop back. This is because, in this embodiment, a single VPS does not provide the  
10 answerphone for all subscribers. Rather, each of a plurality of VPSs provides the answerphone for a subset of all subscribers. In a situation where a call is forwarded to a VPS to be proceeded to the answerphone service although the mailbox to be accessed is managed by another VPS, the current VPS identifies the correct VPS via the SLR 18 and MSC 2 and redirects the call to  
15 the correct VPS, appending the mailbox number to the destination address, the routing number of the correct VPS forming the prefix of that address. Situations where a call drop back may occur are described hereinafter.

Accordingly, in the case of a call drop back, the mailbox number is contained in the destination address specified in signalling associated with the  
20 call. In this case, the service module proceeds to step 32 and checks whether the caller is abroad, i.e. whether the signalling associated with the call indicates a call of international origin. An international call is then processed

in the international mode at step 34, whereas a national call is processed in the normal retrieval mode at step 36. The service module proceeds the call to step 36 if a call by a subscriber to the common number of the answerphone service from a national phone other than his/her handset, and for which the CLI is  
5 unavailable, is redirected to another VPS due to a call drop back.

If no mailbox number is detected in step 30, the service module generates a prompt in step 38 for the caller to enter into his/her telephone the number of the mailbox to be accessed. There are three types of incoming calls that are processed in step 38. The first type is a call originated abroad to the  
10 common number of the answerphone service from a subscriber who wishes to retrieve a message from the answerphone service. The second type is a call to a subscriber abroad, which call is diverted to the answerphone service via a visited network which does not pass the divert flag or provide the CLI in the signalling sent over the interconnect links. The third type is a call to the  
15 common number of the answerphone service of national origin from a subscriber using a phone other than his/her handset, and for which the CLI is unavailable, first being processed by a VPS.

After reception of a number which has been entered by the caller into his/her telephone in step 40, the service module checks in step 42 whether the  
20 entered number is a valid mailbox number. If no valid mailbox number has been entered, the service module returns to step 38. Otherwise, the service module proceeds to step 43 and checks whether the mailbox corresponding to

the entered mailbox number is managed by a different VPS and, in that case, causes a call drop back at step 44. If the mailbox is managed by the same VPS, the origin (whether international or national) of the call is checked by determining whether the international origin flag is set in the signalling associated with the call, step 45. If the call is of international origin, the call is processed in international mode, step 46. Otherwise, the call is processed in normal retrieval mode, step 48.

Figure 3 shows the steps taken by the service module in the normal deposit mode. A set divert flag at step 22 in Figure 2 indicates that a call has arrived at a subscriber's handset within the home network area but has subsequently been diverted to the VPS. However, the subscriber's CLI is not necessarily available since the subscriber has the option to preset his/her handset not to transmit the CLI. Accordingly, the service module checks in step 50 whether the CLI is available. If the CLI is available, the CLI is used in step 52 to identify the subscriber's mailbox number. If no CLI is available, the service module prompts the caller in step 54 to enter the mailbox number, receives the mailbox number in step 56 and verifies in step 58 whether a valid number has been entered. The identified/entered mailbox number is used to access the subscriber's mailbox in step 60. The service module then plays a personal deposit message by the subscriber to the caller in step 62 and receives a voice message from the caller in step 64.

Figure 4 shows the steps taken by the service module in the normal retrieval mode. The service module proceeds to the normal retrieval in three cases. The first and second case are shown in Figure 2. In the first case, the received call is not diverted and is provided with the CLI, this being the  
5 directory number of the handset from which the call is made. Accordingly, in this case, the call has a national origin and is directed to a common telephone number of the answerphone service. The second case results if a subscriber has entered his/her mailbox number to access his/her mailbox via a national telephone call to a common telephone number of the answerphone service  
10 from a telephone other than his/her handset.

The normal retrieval mode starts with the playing of a retrieval message to the caller in step 66. The retrieval message may comprise a retrieval message which allows the user to select from various services such as the retrieval of particular ones of the messages on a subscriber's mailbox, the deletion of messages, etc. If the star key of the caller's telephone is  
15 pressed during the playing of the retrieval message as indicated at step 68, the service module proceeds to step 70 and prompts the user to enter a mailbox number (the directory number of the subscriber having the mailbox) which is desired to be accessed. The service module receives a number in step 72 and  
20 checks in step 74 whether the entered number is a valid mailbox number. If the entered number is invalid, the service module returns to step 70. Otherwise, it checks in step 76 whether the mailbox associated with the

entered mailbox number is provided in the current or in a different VPS. In the former case, the service module returns to step 66. In the latter case, the service module initiates a call drop back in step 78.

5 If the star key has not been pressed in step 68, the service module checks in step 80 whether a mailbox number is available. Only if no mailbox number is available, the CLI (the directory number associated with the handset being used) is used to obtain the mailbox number in step 82. This is to prevent that a wrong mailbox is accessed if a subscriber uses another subscriber's handset to access his/her mailbox, namely the mailbox associated with the CLI and not the mailbox associated with an entered mailbox number. 10 In step 84, the service module prompts the caller to enter a PIN code in order to get authorised access to a mailbox. The PIN code is received in step 86. If the star key is pressed at this stage in step 87, the service module proceeds to step 70. Otherwise, the entered PIN code is checked for validity in step 88. 15 Step 84 is repeated if the entered PIN code is invalid, whereas the mailbox is accessed in step 90 on entry of a valid PIN code. The service module then proceeds to step 92 and plays the message to be retrieved to the calling subscriber.

Figure 5 illustrates the steps taken by the service module in the 20 international mode. The international mode either provides for the deposit of messages for a subscriber by a caller, or for the retrieval of messages by a subscriber. Due to a lack of information in the international signalling, the

two cases are distinguished by DTMF input by the subscriber on connection of the call to the answerphone service.

In step 94, a mailbox is accessed by using the mailbox number which previously had to be entered. The service module then plays a personal  
5 deposit message by the subscriber in step 96. If during this time the star key of the used telephone is pressed, the service module proceeds to the normal retrieval mode in step 100. Otherwise, the service module receives and stores a message from the caller in step 102.

It should be noted that the present invention is not limited to the  
10 embodiment as described hereinabove. In particular, the steps taken by the service module may well be applied in a different order. It is envisaged that various modifications and variations to the above described embodiment could be made, without falling outside the scope of the present invention which is to be determined from the appended claims.